Task 12: Normal Operations Safety Survey (NOSS) input into Human Reliability Estimation (Bailey)

Program Manager: Edmundo A. Sierra, Jr., Scientific and Technical Advisor for Human Factors, AJP-612, (202) 267-7867, edmundo.sierra@faa.gov

Task Customers/Sponsors
Paul Krois, Program Director (Acting), Human Factors Research & Engineering. AJP-61, 202-493-5310

Performing Organization: NAS Human Factors Safety Research Lab, AAM-520
Larry Bailey, Ph.D., AAM-520. (405) 954-6839, Larry.L.Bailey@FAA.Gov

University/Contract Performing Organization:
Raytheon ATC SMEs

Project Start Date: February 1, 2010 **Anticipated End Date:** September 30, 2010

Requirements Statement
Operational Shortfall or Knowledge Gap The ATO's current Safety Management System (SMS) lacks the ability to monitor the presence of human errors that are frequently associated with Operational Errors (OEs). Although data currently collected during a Normal Operations Safety Survey (NOSS) provides insight about the types of threats and about human error that exists, the NOSS data do not directly map onto the causal factors used in identifying the human factors causes of OEs. Thus, a need exists to develop a linkage between NOSS and the human error causal factors as reported in the FAA's OE Form 7210-3.
Benefit in Closing the Shortfall or Gap By monitoring the human errors in NOSS that are related to OE causal factors, the SMS would be able to track progress toward OE reduction. Although OEs are relatively rare, it is thought that the human errors associated with them are more prevalent and thus would be more suitable for measuring the effect of interventions designed to reduce OEs.
Description of the Desired Product 1. Identify NOSS human error codes associated with each of the six human error casual factors listed in form 7210-3: (a) data posting errors, (b) radar display errors, (c) air craft identification errors, (d) communication errors, (e) coordination errors, and (f) position relief briefing errors. 2. Identify over-sampling (i.e., numerous NOSS codes) and under-sampling (i.e., few NOSS codes) of NOSS as it relates to the six human error causal factors. 3. Suggest additional behavioral markers of under-sampled human error causal factors. 4. Develop a NOSS report template suitable for use in OE monitoring. 5. Use NOSS template on Minneapolis and Indianapolis NOSS data.
Schedule FY11

Research Objective

There are two research objectives: (1) Evaluate the utility of NOSS to inform the ATO's SMS about human errors that are related to the OE causal factors, and (2) To analyze NOSS data using a NOSS report template suitable for monitoring the effectiveness of interventions designed to reduce OEs.

Because human reliability analysis is focused on identifying the risks associated with various types of human error, a parallel effort needs to be initiated to develop appropriate countermeasures to mitigate what is determined to be an unacceptable safety risk. The work being proposed in this PD only addresses quantifying the risk and not the identification of countermeasures.

Background

The Air Traffic Organization (ATO) Safety Services is the focal point for the application of the FAA's Safety Management System principles which include: Safety policy, safety risk management, safety assurance (safety audits, evaluations, quality assurance and quality control), and safety promotion (SMS training, promoting an open and proactive safety culture, reporting findings to improve safety performance, and related actions). One of the metrics used by the ATO to monitor the overall safety of the National Airspace System (NAS) is the rate of OEs (defined as the number of OEs/number of operations) that occur each year. Each year the ATO sets a not-to-exceed OE rate as a safety goal and then tracks its success at achieving that goal. If the ATO's safety goal is not met, then steps must be taken to identify and resolve the problems that created the excessive OE rate.

Problem identification involves an assessment of the organization and or human factors that contributed to the OE. The procedures for conducting the OE assessment are detailed in the FAA's Air Traffic Quality Assurance Order 7210-56. The OE assessment is conducted in two phases. Phase one consists of a preliminary investigation and focuses on describing the who, what, when, and where of the situation. Also included in phase one is a verification that an OE actually occurred, which, at times, cannot be known until sufficient data are examined. This information is documented using form 7210-2. Phase two consists of a comprehensive investigation that expands on what was discovered during phase one by including the how and why the OE occurred. This information is documented using form 7210-3 and includes, among other things, a summative description of the time sequence of events leading up to the OE, the controller actions or inactions that contributed to the OE, and the organizational and contextual factors that may have contributed to the OE. Additionally, form 7210-3 also provides a checklist of human factor causes associated with the OE. The checklist is organized under six headings: (a) data posting, (b) radar display, (c) aircraft observation, (d) communication, (e) coordination, and (f) position relief briefing.

Historically, the measurement of the human error associated with controlling traffic has been limited to the tracking of air traffic control OEs and their human factors causes. Implicit in the

tracking of OEs was the assumption that controllers who committed them must have departed from following established policies and or procedures. That is, controllers who committed OEs must have done something wrong. Based on this premise, interventions designed to reduce OEs focused on remedial training for the controller(s) involved. What was lacking from this approach, however, was the absence of information about the types and frequency of human error associated with controlling traffic when OEs did not occur. Without information about human errors during normal (without OEs) operations, there was no way of knowing whether OEs were a property of the specific individuals who committed them or whether the same mistakes happened within the broader controller population even when OEs were not occurring.

Recently the ATO has experimented with using the Normal Operations Safety Survey (NOSS) as a tool for monitoring the threats and errors that exist within air traffic control under normal operations (without OEs). A threat is defined as an event or error that occurs outside the influence of the controller, but which requires his or her attention and management if safety margins are to be maintained. An error is defined as an observed deviation from organizational expectations or controller intentions. An error that results in a situation involving a clear reduction in safety margins is said to cause an undesirable state. All OEs result in undesirable states; however, only category A&B OEs (the most severe) are included in the ATO-S OE safety metric. NOSS classifies controller errors into five categories: (a) position change errors, (b) communication errors, (c) procedural errors, (d) Equipment/Flight Data Processing System (FDPS) errors, and (e) aircraft instruction errors. As reported in the literature, NOSS was developed as a means to inform an organization's SMS about threats and errors that exist under normal operations. Although useful in its own right, there is a difference between the NOSS categories used to report human error and the Form 7210-3 categories used to report causal factors associated with OEs.

One reason that there is a difference between NOSS categories and the OE human factors categories is that NOSS focuses on those human errors that can be observed by others. In contrast, the OE human factors categories includes those errors that are behaviorally-based as well as those associated with information processing. While NOSS recognizes that human errors associated with information processing are important, since information processing errors cannot be observed, they are not included in NOSS trials. However, a problem exists with NOSS' focus on behavioral observations. Most OEs are the result of human information processing errors, such as those involved with perception, memory, and planning and decision making (Bailey 2005). Thus, although NOSS trials capture the types of errors that are readily observed, they may not readily capture the types of errors that are more commonly associated with OEs. Thus, interventions designed around NOSS data may make a facility's operations safer; however, the impact on OE reduction may not be as great. A need, therefore, exists to conduct research to identify errors in information processing that may be auditable through the use of existing or newly developed technology. If possible then, revisions to the NOSS error categories can be made so that a more comprehensive analysis can be conducted on the occurrence of human error during normal operations.

Previous Activity on this Task

NOSS trials have previously been conducted at the Indianapolis and Minneapolis ARTCCs.

Proposed or Planned Research
This research proposes to map NOSS human error category codes onto the causal factors categories used in form 7210-3. This mapping will then identify areas where NOSS information can directly inform SMS about OEs and areas NOSS does not address. In the areas that NOSS does not address, a panel of ATC SMEs will be convened to examine how existing or newly develop technologies could be used to develop relevant information. Output from the panel will be used to develop suggested revisions to NOSS codes and serve as a template for conducting future NOSS trials.

Research Question(s)

1. What percentage of NOSS human errors are related to the types of causal factors identified at OEs at Minneapolis and Indianapolis ARTCCs?

2. What types of existing or newly developed technologies could be used to make information processing errors observable under normal operations?

Technical Approach

Current Year
NOSS and OE data from Minneapolis and Indianapolis ARTCCs will be used as primary data sources.

Out-Years
Additional data from other NOSS trials may be used.

Air Traffic Resources Required

Access to NOSS and OE data collected at the Minneapolis and Indianapolis ARTCCs.

Calibration
None

FY10 Milestone Schedule		
Description	Proposed Start Date	Proposed Completion Date
Project Start-up • Submit project description for sponsor approval • Obtain clearance for accessing NOSS data base • Obtain clearance for accessing OE data base • Submit IRB.	February 1	February 28, 2010
NOSS Mapping unto Form 7210-3 • Identify over and under sampling	March 1	April 30, 2010
SME Panel • Identify types of auditable indicators of information processing human errors associated controlling traffic • Identify existing and or newly developed technologies needed to conduct information processing audits.	June 1	July 31, 2010
NOSS Revisions • Revise NOSS human error codes to include results of SME panel recommendations	August 1	September 15, 2010
End of Project Briefing		November 30, 2010

FY10 Deliverables		
Description	Proposed completion date	Actual completion date
Matrix of NOSS categories and form 7210-3 causal factor categories	May 31, 2010	
NOSS OE Reporting Template	September 15, 2010	
End of Project Briefing	November 30, 2010	
Supporting materials will be provided at the request of the AJP-61 Program Management. These include power point charts and briefing slides for TCRG meetings, abstracts for reports that don't already include them, quarterly reports, and text for the annual report summarizing the year's activities.	As needed	